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THE RESPONSIBILITY OF THE AGRICULTURAL EXPERIMENT STATION IN THE PRESENT AGRICULTURAL SITUATION[1]

SITUATIONS—good, bad or indifferent—are the common lot of man and of all groups and associations of men. Your program committee was therefore perfectly safe in assuming that there is an agricultural situation.

It was probably equally safe in assuming that the agricultural experiment stations of our country have some responsibility in connection therewith.

Some critics have gone so far as to hold the experiment stations responsible *for* the present situation, stating that were it not for the experiment station and the agricultural extension service there would be no agricultural situation, of the present sort at least. This is very likely true. Our agriculture might, however, be in the "fire" instead of the "frying pan."

I take it that the province of this discussion is to consider rather the responsibility of the agricultural experiment station *in* the existing situation.

Before the experiment station can get very far in the exercise of its responsibilities it will have to know very definitely what the agricultural situation is. As a "fact-finding" institution perhaps this is its first work, to find the facts as to the actual situation.

Having found these facts, it will be in order to determine the several causes which have resulted in the present situation; and, finally, to suggest courses of action, based upon researches, which give promise of remedying the situation.

We have quite a variety of opinions and pronouncements as to the agricultural situation—a situation which naturally changes very considerably month by month and year by year, as witness the change in the list of "basic" products in successive editions of the McNary-Haugen Bill. The price of eggs for several months past has indicated that the next edition of this bill would include eggs as one of the basic products, along with rice and tobacco!

The present agricultural situation has been described by some as "the farmer's failure to get his

[1] Address delivered at the forty-first annual convention of the Association of Land-Grant Colleges and Universities, Chicago, Illinois, November 15, 1927, by Director C. G. Williams, Ohio Agricultural Experiment Station.

share of the national income," and by others as his "inability to earn sufficient return upon his investment." Recently the agricultural committee of the International Economic Conference described the situation as "the disequilibrium which has arisen between the prices of agricultural products and manufactured products." This definition comes from an accredited source and is perhaps as satisfactory as any.

Now disequilibriums are usually brought about, the economists tell us, by maladjustments between the supply of and the demand for products. I take it, then, that the experiment station should make a thorough study of the production and consumption of the agricultural products in which its constituents are actively interested with a view of determining the actual situation.

WHEAT PRODUCTION AND CONSUMPTION

Take the wheat crop, for instance. What has happened to it during the last forty years? Comparing the five-year period 1885–1889 with 1920–1924, it appears that our acreage per capita was 0.57 in the earlier period and 0.52 in the later, or a decline of 8.8 per cent. But, owing to increased yields per acre, our production per capita increased during this period from 6.77 bushels to 7.26, or 7.2 per cent. This increase in production would not seem to be a serious matter if the other factors bearing upon the wheat situation were unchanged. Unfortunately for the wheat farmer the factor of consumption has not remained the same. According to figures gathered by the U. S. Department of Agriculture the per capita consumption or "disappearance" of wheat has declined 1.1 bushels during the period in question. This, with the increased production of 0.49 bushel, makes an excess of 1.59 bushels per capita above the supply of thirty-five years ago.

How shall we account for this reduction in the consumption of wheat? Is it a permanent reduction, and is there a possibility of its increasing?

Wheat is one of our greatest energy-producing foods, and, in common with other foods of like character, is in less demand now than formerly because less hard physical labor is called for in the world's work. For one, and perhaps the most important thing, during the last forty years two hours have been clipped off the day's work of almost our entire population. While our farm population is not working an eight-hour day, it is probable that the farmer's working day has been shortened in proportion. Eight and ten hours of labor do not call for the amount of energy-producing foods that ten and twelve hours of labor require.

Then the tasks of the laborer, both in the manufacturing industry and on the farm, have been greatly lessened in so far as the physical energy called for is concerned by the marvelous line of machinery now in use.

SUBSTITUTING ONE FOOD FOR ANOTHER

Partly as a result of these changed conditions and partly as a result of propaganda other foods, such as vegetables, fruits and milk, are being substituted for these energy-producing foods. Physicians, nutrition experts, and, sometimes it seems, the very "stars in their courses" are adjuring the public in their behalf. Still other foods have been called into increased use during recent years, notably poultry, eggs and sugar. All these changes mean a decreased demand for wheat and meats as a whole, though the consumption of pork shows an increase, but very likely a temporary one. Limits have been set to the capacity of the human stomach. More fruit, milk and eggs necessarily mean less bread and meat. And less hard labor means less energy-producing foods. So far as one can now see these conditions are here to stay and will result in a permanent, and possibly in a still further reduction in the demand for wheat as far as this country is concerned.

This study would have to take into consideration foreign production and consumption, for so long as we have to depend upon a foreign market for the utilization of a portion of our product so long will foreign conditions and tendencies be of concern to us.

Some such study as has been briefly and incompletely indicated for wheat would seem to be within the province of the experiment station for all the crops in which its constituency is interested. In so far as the present agricultural situation is due to production, consumption and consequent price relationships, such studies should prove of value. They should include investigations of the effect of temporary increases and decreases in production prices, concerning which our data are limited.

But there are doubtless many things which have had to do with the present agricultural depression which need investigation.

TAXES

There is need for a thorough study of taxation as related to farm property. Our farmers are paying on the average 150 per cent. greater taxes now than in 1914. No other farm expense has increased in like ratio. A careful study should be made of rural as compared with urban taxation. Studies now under way in some sections are showing that while rural real estate is on the tax duplicate for 88.4 per cent.

of its sales value, urban property in the same county is assessed at 63.2 per cent. of its value. Reliable facts of this kind are being used very effectively in securing proper readjustments of the tax duplicate.

There are other tax burdens resting upon farm property that are in need of adjustment, which it would not be difficult to secure if all the needed facts were available. Fifteen years ago our cross-country roads were seldom used by traffic originating in the city. They were the farmer's own roads, and it was proper that he should make and maintain them. The situation is very different to-day and reliable facts on the existing situation would be very useful.

Our cities are not only interested in the country roads but in the youth of the country. These country boys and girls are educated at the expense of the rural community, but as soon as they arrive at a productive age many of them go to the city. Would it not be desirable to know all the facts involved in this transfer of rural wealth to the city? Is it not likely that such knowledge, if properly handled, would result in the shifting of a portion of this tax burden from the country to the city?

TARIFF

Does any responsibility rest upon the agricultural experiment station to make a study of the effect of the United States tariff on agriculture?

Of partisan opinions, both for and against the present tariff schedules, there are an abundance. While many investigations of a nation-wide bearing can very appropriately be undertaken by the United States Department of Agriculture it would hardly be possible for the department to conduct such an investigation because of its political connections. It would doubtless be difficult enough for a state experiment station to do so, but we surely need information as to the effect of the tariff on prices in this country. Such questions as:

Is the American price of protected articles always, usually, seldom or never equal to the foreign price plus freight and tariff?

To what extent are American products that are favored by a tariff sold abroad, and at what prices?

Are the products which are sent abroad sold at a loss or at a profit?

Is there any significance in the fact that many of the heavily protected articles, such as iron, steel, structural steel and chemicals, are selling nearer prewar prices than grains, meats and dairy products?

How does the efficiency of the American laborer compare with that of the European laborer?

These questions may have some bearing upon the agricultural situation. The agricultural public would like information on them. Should not the experiment station help secure this information?

FARM LABOR

To what extent do the high wages of farm labor contribute to the agricultural situation?

In considering the principal items which make up the expenses of the farmer, including labor, machinery, feed, taxes, fertilizer, buildings, clothing, furniture, groceries, fuel and a group of miscellaneous items, farm labor is the second highest of the lot in comparison with pre-war prices, being exceeded by taxes only.

The wages of farm labor are influenced by the wages in manufacturing industries, though they have not increased in proportion to the latter.

It might contribute something to the mental condition of the farmer if he had some reliable data on the relative efficiency of farm labor now as compared with ten or twenty years ago. An investigation might show an increase of 30 to 60 per cent. in the productive efficiency of farm labor, as is believed by some people. Whatever the findings, it would seem that studies as to the efficiency of man power on the farm, the average working hours per day and working days per year would contribute information of considerable value in discovering what the agricultural situation is, and in adjusting ourselves to it.

In the time available it will not be possible to consider very many of the causes which may be contributing to the present situation. A few minutes should be given to lines of investigation tending to improve the situation.

ECONOMICAL PRODUCTION

Economical production is still the great question for a vast number of our farm people. A large proportion of the questions put up to the experiment stations to-day have to do with production. These questions have by no means been solved. When farm management studies conducted in one county of an important corn state show some corn growers investing in an acre of corn 260 per cent. more man hours and 177 per cent. more horse hours than other growers, and at the same time securing smaller yields per acre, there would seem to be room for improvement. There are individual variations of this sort in most neighborhoods, and frequently whole counties or sections of states show variations of moment which would be gradually corrected if attention were called to these differences by a comprehensive study of conditions. Such changes make for more profitable farming.

Most of our experiment stations have conducted, or are conducting, extensive soil surveys of their respective states. These soil surveys should be followed by equally thorough ecological surveys. Many of our farmers are attempting to grow alfalfa and sweet clover on land better adapted to alsike clover and timothy. Potatoes, tobacco, sugar beets and many other crops are often carried to soils and climates in which they are not at home and where they can not be grown economically. A better adjustment of crops to soil and climate will most certainly result in more economical production.

THE CEREAL-LEGUME RATIO

More investigations need to be conducted relative to the most desirable cereal-legume ratio. Grouping the non-legume potatoes and sugar beets with the cereals for the present purpose, it will be found that for the average of the years 1924–1926 the ratio of cereals to legumes seems to run from 2.7:1 in Michigan to 45:1 in North Dakota. And if cotton be included, Texas has a ratio of over 70:1, though possibly the legume figures as given in the Yearbook of the U. S. Department of Agriculture may not be complete for this state.

It is evident that if our leading corn belt states were to go from perhaps an average ratio of 8:1 to 3 or 4:1 our cereal surplus problem would be pretty well taken care of, even in a good season.

Our increased acreage of legumes would be used mainly for soil improvement, which would result in larger yields of non-legumes per acre, though in a smaller total production, and our production costs per unit would thus be reduced.

ADJUSTING AGRICULTURAL PRODUCTION

It would seem that the time has arrived when our farm people must exercise a greater control over production. In so far as live stock is concerned this is comparatively easy, for we have matters largely in our own hands. If there is overproduction it is evident who is to blame. We are controlling production now, but not always in a wise and profitable way. Our hog men are simply a few months behind the game. Investigations like those reported in a recent bulletin from Illinois (Bulletin 293) on "Adjusting Hog Production to Market Demand" will have beneficial results.

In crop production matters can not be controlled as easily. A reduced acreage will, on the average, result in reduced production, but there will be exceptional seasons in which this will not hold good. If nature is especially kind one season we shall have to learn to limit our acreage the next season, or until the old surplus can be marketed satisfactorily. I fear that any plan to buy up surplus products and hold them until they can be marketed at a profit is doomed to fail unless some control over production is provided; but as yet no one seems to have suggested a workable control.

There is, however, no reason to believe that farmers can not learn to cooperate in these matters. The Canadian Wheat Pool, which controls 75 per cent. of the wheat acreage of Canada, is an encouraging sign of the times. Once we get over the notion that we are going to make Uncle Sam hold the bag and pay round prices for whatever we care to dump into it we may be able to engage in cooperative marketing as wisely and as satisfactorily as some other farm peoples have done. As a matter of fact the agricultural census of 1925 shows that the necessity for decreased production is being appreciated along many lines, and there is good reason to believe that the desired equilibrium between agricultural and other prices is gradually approaching.

America is anxious to maintain and increase its present high standard of living. This rests, in the main, upon the high-wage scale prevailing in this country. There would seem to be only two ways in which we can operate on a higher wage scale than Europe, and these are to produce more per man—*i.e.*, produce more economically—or confine our production to the needs of our own people. When we go into the markets of the world we shall have to accept world prices. Any attempt to give ourselves a bonus on exports will be almost certain to be met with a retaliatory tariff in every country except where it is desired to take advantage of cheap food, the better to compete with American manufacturers. And this would have to be offset here by a higher tariff, which means that we should soon get dizzy traveling around in a circle. Confirmation of this attitude on the part of foreign countries is to be had by the recent proposal of the National Farmers' Union of England that "counter-availing safeguards to home production, to meet bounty-fed competition from abroad be adopted."

There are two ways of attacking the problem presented by the present agricultural situation. One is agricultural research, followed by such economies and adjustments as may be indicated, together with commodity organization. The other is the Via Dolorosa of political nostrums. If the agricultural experiment stations rise to the occasion we may be saved from the latter.

C. G. WILLIAMS
OHIO AGRICULTURAL EXPERIMENT STATION

LOUIS AGASSIZ AND THE HALL OF FAME[1]

NEARLY a century ago Louis Agassiz, following his friend Charpentier, boldly set before his confreres in the infant Academy of Neufchatel the novel and apparently revolutionary theory of a Glacial Age in which a mantle of ice covered the Alps and extended widely over Europe. This induction, conceived during his youthful encampment upon the Aar Glacier and his descent into its very heart, led step by step to our present knowledge of the repeated glaciations not only of the northern hemisphere but of the entire globe. The ten years between 1837 and 1847 Agassiz devoted to establishing this theory, and from the time of his arrival in Massachusetts in 1846 he was delighted to witness the vestiges of glaciation in North America, and before he passed away in 1873 he experienced the conversion of a startling and fantastic hypothesis into a well-established principle of the earth's history. This brilliant induction at the age of thirty yields the secret of Agassiz's great career, epitomized on the walls of his Penikese laboratory in four words: "Read Nature Not Books." For, next to his unrivaled inspiration as a teacher came his revolutionary insistence upon direct recourse to nature summed up in one of his most beautiful sentences, "If you study nature in books, when you go out-of-doors you can not find her." There never was a day in American educational history in which this observational method of Agassiz was more glaringly needed than the present day.

The little Swiss Canton of Neufchatel yielded not less than three great gifts of Switzerland to the United States—to Princeton University Arnold Guyot, comrade of Agassiz in glaciation; to our National Geological Survey Leo Lesquereux, classmate and comrade in botany; to all America Louis Agassiz, naturalist, geologist, zoologist. The French and Swiss social revolution of 1848, which hastened the departure to our shores of these three great men, inaugurated among us a scientific metempsychosis, the effects of which are quite beyond calculation. Into our practically virgin field of natural history, Agassiz brought the great traditions of his master, Cuvier, the brilliant founder of paleontology; of Humboldt, then the most influential scientist of Europe; of the British geologists, Buckland, Murchison, Sedgwick and Lyell. While never destined to be a disciple of Darwin, he paved the way for evolution through newer conceptions of creation in his titanic researches on living and fossil fishes, as well as through the vistas of geologic time in his glaciation theory and in his insistence upon the observation of nature.

Following to America the ardent French pioneers and explorers, Rafinesque, Bonaparte, Audubon and Lessen, Agassiz brought with him the great traditions and canons of the European school as well as the example of research and publication in all branches of natural history, especially the life of the sea. Our birds, mammals and reptiles had been discovered and described by early French, Spanish and English explorers; it remained for Agassiz to explore our beautiful seacoast and to show the romance in the life of the sea. Thus his third great contribution to America was his creation of a school of explorers of the world beneath the waters—a school which numbered among its pupils all the distinguished men of American biology enrolled in our National Academy of Sciences between the years 1846 and 1873, besides the hundreds and even thousands of laymen who were attracted by his contagious enthusiasm.

To his leadership, exerted to arouse public interest and attention, we owe directly our seashore laboratories and many of our museums. It was he who inspired young Albert Bickmore, the creator of the American Museum of Natural History, and his own son Alexander, the founder and benefactor of the Cambridge Museum of Comparative Zoology, in the days when the National Museum of the Smithsonian Institution and others were not yet dreamed of. Every American college and university of the fifties, sixties and seventies filled its chairs of zoology by a pupil of Agassiz. Thus his influence extended a thousandfold.

These are the four outstanding reasons why the bronze portrait of Louis Agassiz should be placed in this Hall of Fame to-day. Is it not a felicitous example of the power of heredity that Alpheus Hyatt, perhaps the most original and skilful disciple of Agassiz and a master of form in the science of paleontology, should be the father of Anna Vaughn Hyatt, the very gifted sculptress, who has to-day in this beautiful bronze perpetuated the name and fame of Louis Agassiz.

HENRY FAIRFIELD OSBORN
AMERICAN MUSEUM OF NATURAL HISTORY

[1] Address at the Hall of Fame of New York University, on Thursday, May 10, 1928, at the unveiling of a bust of Jean Louis Rudolphe Agassiz.

ERNST J. LESSER

THE sudden death of Dr. E. J. Lesser, biological chemist at the City Hospital in Mannheim, Germany, involves a very great loss to medical science. He possessed the qualities of the true research worker in a very exceptional degree. He had insight and enthusiasm;—and these were combined with exemplary

patience, caution, self-criticism and a remarkable technical skill. Those who knew him were impressed by his gifted, generous and beautifully modest personality as well as by his deep understanding of other fields of knowledge. Dr. Lesser studied medicine in Freiburg and Munich. After taking his degree he worked in the physiological laboratories of Voit in Munich and Bernstein in Halle. In 1906 he was made "Privatdozent," submitting a thesis on the electromotoric force of the current of the frog skin. The following years mark the beginning of a series of investigations on life without oxygen, which led to the important observation that there occurs a restitution of glycogen when frogs are allowed to recover after a period of anoxibiosis. This phenomenon of oxidative recovery is now one of the basic laws of muscle physiology. In 1910 Dr. Lesser accepted the position in Mannheim, which he held until his death, with only a short interruption during the war, when he substituted as professor of biological chemistry at the University of Strasbourg. His work on the diastatic ferment of the liver led him into a broad investigation of carbohydrate metabolism which made him a recognized leader in this field. Here he succeeded in the preparation of an active extract of the pancreas, but before he was ready to publish his results, which he wanted to elaborate as far as possible, there appeared the first paper of Banting on insulin. Interested only in the progress of science and not in personal matters, he kept this fact secret—only his intimate associates knew of it—and never made any claims of priority. His series of papers on the nature of the action of insulin is a classic and his summarizing articles in text-books and reviews are proof of the clarity and penetration of his mind. Not surrounded by the glamor of an academic position, he did not receive the full recognition of the high qualities of his character and his work at the early age at which he died.

CARL F. CORI

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BUFFALO, N. Y.

SCIENTIFIC EVENTS

THE SECOND INTERNATIONAL CONFERENCE ON BITUMINOUS COAL

BETWEEN 60 and 70 scientists and fuel technologists in eleven different countries have tentatively accepted invitations to speak at the second International Conference on Bituminous Coal, which will be held at the Carnegie Institute of Technology in Pittsburgh, Pennsylvania, during the week of November 19. The list includes about forty Europeans whom Dr. Thomas S. Baker, president of the Carnegie Institute of Technology, personally invited while making his recent two months' visit in Europe in the interests of the conference.

It is announced that the purpose of the congress is similar to the one held in 1926 by the Carnegie Institute of Technology: to present the results of recent studies of coal that have to do with improved methods of utilization and combustion. The program will include the discussion of low temperature distillation, high temperature distillation, coal tar products, power, smokeless fuel, complete gasification of coal, hydrogenation, pulverized fuel and its new applications, fixation of nitrogen, coal beneficiation, etc.

Upon his return from Europe in April, President Baker expressed the opinion that the second conference will be much larger in scope and importance than the first, and that the number of delegates from foreign countries will be considerably in excess of that at the 1926 meeting, when thirteen different nations were represented.

Among the distinguished scientific men in Europe who have either definitely or tentatively accepted invitations to speak are the Right Honorable Sir Alfred Mead, Harald Nielsen, Dr. Cecil H. Lander and Dr. R. Lessing, of England; Donat Agache, president of the executive board of the Kuhlmann plants; André Kling, director of The Municipal Laboratories of Paris, and Henri Lafond, International Company for the Manufacture of Gasoline and Oils, France; Dr. Friedrich Bergius, inventor of the Bergius process for the production of oil from coal; Dr. Franz Fischer, director of the Kaiser Wilhelm Institute for Coal Research; Professor Fritz Hoffman, inventor of a process for manufacturing synthetic rubber from coal; Dr. Carl Krauch, director of the I. G. Dye Trust, and Rudolph Rawlikowski, of the Cosmos Machine Construction Institute, Germany, and many others.

Professor Sumner B. Ely, of the Carnegie Institute of Technology, is secretary of the conference. The advisory board includes John Hays Hammond, E. M. Herr, Samuel Insull, Frank B. Jewett, Otto H. Kahn, George E. Learnard, the Honorable A. W. Mellon, Auguste G. Pratt and Charles M. Schwab.

THE SIXTH NATIONAL COLLOID SYMPOSIUM

THE Sixth National Colloid Symposium will be held under the auspices of the Colloid Division of the American Chemical Society at Toronto, Canada, June 14, 15 and 16, 1928, with Sir William B. Hardy, of Cambridge, England, as the guest of honor. The following program of papers has been announced by the chairman, Professor Harry B. Weiser, The Rice Institute, Houston, Texas.

Sir William B. Hardy, Cambridge, England (title not yet available).

Dr. H. A. Abramson: Cataphoresis of blood cells and inert particles in sols and gels and its biological significance (with motion pictures).

Wilder D. Bancroft and C. E. Barnett, Cornell University: Adsorption of methylene blue by lead sulfate.

David R. Briggs, University of Minnesota: Surface conductance.

E. F. Burton and Beatrice Reid Deacon, University of Toronto: Influence of temperature on coagulation of colloidal solutions.

John R. Fanselow, University of Wisconsin: The influence of electrolytes and non-electrolytes upon the optical activity and relative resistance to shear of gelatin systems.

William D. Harkins, University of Chicago: Charges on colloidal particles, adsorption, and the spreading of liquids.

A. B. Hastings, University of Chicago: The rôle of hemoglobin in the blood.

Ernst Hauser, Frankfurt am Main, Germany: New microscopic methods in connection with the problem of vulcanization.

Emil Heuser, International Paper Company, Ontario: Problems of cellulose chemistry.

Harry N. Holmes and Robert C. Williams, Oberlin College: The uniform distribution of catalysts throughout porous solids.

F. B. Kenrick, University of Toronto: The effect of adsorbed water on electrical conductivity of powders.

John C. Krantz and Neil E. Gordon, University of Maryland: Hydrogen-ion concentration and stability of emulsions.

M. E. Laing, J. W. McBain and E. W. Harrison, Stanford University: Adsorption of sodium oleate at the air-water interface.

J. W. McBain, W. F. K. Wynne-Jones and F. H. Pollard, Stanford University: The activity and adsorption of p-toluidine in the surface of its aqueous solutions.

P. J. Moloney and Edith M. Taylor, Connaught Research Laboratories: Fractionation of diphtheria anti-toxic sera.

Stuart Mudd, Baludin Lucke, Morton McCutcheon and Max Strumia, University of Pennsylvania: Relation between surface properties and phagocytosis of bacteria.

H. A. Neville and H. C. Jones, Lehigh University: The study of hydration changes by a volume-change method.

J. B. Nichols, Dupont Company: The development of the ultra-centrifuge and its field of research.

Fred Olsen, Picatinny Arsenal: Influence of gel structure upon the technology of smokeless powder manufacture.

A. J. Phillips, Picatinny Arsenal: Structure of cellulose nitrate and cellulose nitrate gels.

W. L. Robinson, University of Toronto: The filtration of colloids by the spleen.

J. E. Sheppard and R. H. Lambert, Eastman Kodak Company: Grain growth in silver bromide precipitates.

A. J. Stamm, Forest Products Laboratories: The structure of soft-woods as revealed by dynamic physical methods.

H. L. Trumbull, B. F. Goodrich Company: The preparation and properties of rubber dispersions.

Hardolph Wasteneys and H. Borsook, University of Toronto: Emulsions and protein synthesis.

Harry B. Weiser and G. E. Cunningham, The Rice Institute: Adsorption of ions and the physical character of precipitates (with motion pictures).

G. S. Whitby, J. G. McNally and W. Gallay, McGill University: Studies of organophilic colloids.

A BILL TO PROMOTE ETHNOLOGICAL RESEARCH AMONG THE AMERICAN INDIANS

AN appropriation to provide for cooperation by the Smithsonian Institution with state, educational and scientific organizations in the United States for continuing ethnological researches among the American Indians, was approved by the Senate on May 8, when it passed the McKellar bill, which contains the following provisions:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the secretary of the Smithsonian Institution is hereby authorized to cooperate with any state, educational institution, or scientific organization in the United States for continuing ethnological researches among the American Indians and the excavation and preservation of archeological remains.

Section 2. That there is hereby authorized to be appropriated, out of any money in the treasury not otherwise appropriated, the sum of $20,000, which shall be available until expended for the above purposes:

Provided, That at such time as the Smithsonian Institution is satisfied that any state, educational institution, or scientific organization in any of the United States is prepared to contribute to such investigation and when in its judgment such investigation shall appear meritorious, the secretary of the Smithsonian Institution may direct that an amount from this sum equal to that contributed by such state, educational institution, or scientific organization, not to exceed $2,000, to be expended from such sum in any one state during any calendar year, be made available for cooperative investigation:

Provided further, That all such cooperative work and division of the result thereof shall be under the direction of the secretary of the Smithsonian Institution.

THE AWARD OF MEDALS BY THE FRANKLIN INSTITUTE

THE annual meeting for the presentation of medals by the Franklin Institute took place in Philadelphia on May 16. Medals were presented to sixteen men for scientific achievement over a wide field. The Franklin medal, the highest award of the institute, was presented to Dr. Charles F. Brush, inventor of

the arc light, and, through Baron F. von Prittz Witz-Gaffron, the German Ambassador, also to Professor Walther Nernst, of the University of Berlin. Dr. Brush read a paper on radioactive elements. Dr. Nernst's paper was read by Dr. Irving Langmuir, of the General Electric Company, one of his former pupils. Cresson medals were awarded to Henry Ford "in consideration of his rare inventive ability and power of organization"; to Charles L. Lawrance for his development of the air-cooled motor; Professor Vladimir Karapetoff, of Cornell University, for instruments for the mechanical calculation of magnetic and electrical constants of an electrical transmitting line, and Gustaf W. Elmen, of the Bell Telephone Laboratories, Inc., inventor of permalloy, a new alloy of nickel, 100 times more magnetic than iron.

The Henderson medal was awarded for the first time. It went to William F. Kiesel, in charge of the Altoona shop of the Pennsylvania Railroad, for improvement in locomotives and railroad equipment. Arthur Graham Glasgow, of London, received the Walton Clark medal for improvements in the manufacture of illuminating gas.

William E. Taylor, of Corning, N. Y., received for himself and his associate, Eugene C. Sullivan, the Potts medal for development of pyrex, a heat resisting glass. Oscar G. Thurlow, of the Alabama Power Company, also received the Potts medal for designs and inventions applied to hydroelectric plants.

Other awards were: Longstreth medals to Frank N. Speller, of the National Tube Company, for inventing scale-proof iron pipe, and to Warren P. Valentine, of New York, for improving the refractometer and other optical instruments; Wetherill medals to Albert S. Howell, of the Bell-Howell Company, for the development of movie cameras and projectors adaptable to the amateur, and to Frank E. Ross, of the Yerkes Observatory, for designing wide-angle photographic lenses which increase 100 times the astronomical area that can be photographed; and the Levy medal, to Vannevar Bush, of the Massachusetts Institute of Technology, for two papers on electrical power transmission contributed to the *Journal* of the Franklin Institute.

SCIENTIFIC NOTES AND NEWS

DR. HIDEYO NOGUCHI, member of the Rockefeller Institute for Medical Research, died on May 21 in Africa from yellow fever, which he contracted while working on the disease. Dr. Noguchi was fifty-one years of age.

DR. PERCY E. RAYMOND, associate professor of paleontology at Harvard University, has been awarded the Walker grand prize of $1,000, offered every five years by the Boston Society of Natural History. The prize, offered for outstanding discoveries or investigations in natural history, went to Professor Raymond for his work on the trilobites.

As already recorded in SCIENCE, the Linnean gold medal for 1928 has been awarded by the Linnean Society to Dr. Edmund Beecher Wilson, Da Costa professor of zoology in Columbia University. In commenting on this award, *Nature* says: "Professor Wilson's early work dealt with descriptive embryology; in the 'nineties, he took a great part in founding the new science of experimental embryology, and many of his experiments, especially those on *Amphioxus*, *Nereis*, *Patella* and *Dentalium*, remain classical. He is known to a world-wide circle as the author of that admirable text-book, 'The Cell in Development and Heredity.' First published in 1896, a greatly enlarged third edition appeared in 1925. It is a model of what a text-book should be—encyclopedic, trustworthy and judicial—and shows the hand of a master."

AWARD of prizes for the best contributions to the arc-welding art were made at the opening session of the spring meeting of the American Society of Mechanical Engineers at Pittsburgh on May 14. These prizes were offered by the Lincoln Electric Company, of Cleveland, through its vice-president, James F. Lincoln, with the desire to promote the whole art and to reduce the cost of construction. The first prize, $10,000, was awarded to James W. Owens, of Newport News, Va., for a paper entitled "Arc Welding, its Fundamentals and Economics." Professor Henri Dustin, of the University of Brussels, Belgium, received the second prize of $5,000 for his paper on "Fundamental Principles of Arc Welding," while Commander H. E. Rossell, of the U. S. Naval Academy, took the third prize of $2,500 for his review of "Electric Welding of Ship's Bulkheads and Similar Structures."

SAMUEL REA, of Philadelphia, and Sir Ernest Rutherford, of the University of Cambridge, have, among others, been elected honorary members of the British Institute of Civil Engineers.

ON May 3, at the annual general meeting of the British Iron and Steel Institute, the Bessemer gold medal was presented to Mr. Charles M. Schwab, president of the American Iron and Steel Institute and the president of the Bethlehem Steel Corporation.

DR. DEAN LEWIS, surgeon-in-chief, the Johns Hopkins Hospital, has been made a foreign member of the Società Medico-Chirurgica of Bologna and an Ausserordentliches Mitglied der deutschen Gesellschaft für Chirurgie.

THE annual prize established in honor of Howard Taylor Ricketts, who at the time of his death in 1910 was assistant professor of pathology at the University of Chicago, has been divided between George W. Bachman, of Yochow City, Hunan, China, and James Roy Blayney, of Chicago.

THE council of the British Institution of Civil Engineers has made the following awards for papers read and discussed at the ordinary meetings during the session 1927–28: Telford gold medals to Dr. Oscar Faber, London, and G. L. Watson, Newark, New Jersey. Telford premiums to Professor John Goodman, Skipton; James Williamson, Wallington; R. M. Wynne-Edwards, Vancouver, and jointly to F. C. Vokes, Birmingham, and C. B. Townend, Birmingham.

AT the annual meeting of the Royal Institution on May 1, the Duke of Northumberland was elected *president,* Sir Arthur Keith, *treasurer,* and Sir Robert Robertson, *secretary.*

DR. CARLOS E. PORTER, of Santiago, Chile, editor of the *Revista Chilena di Historia Naturale,* has been elected president of the Entomological Society of Spain.

DR. W. R. BROWNE, assistant professor in the department of geology and physical geography of the University of Sydney, has been elected president of the Linnean Society of New South Wales.

DR. ELMER A. SPERRY, chairman of the board of directors of the Sperry Gyroscope Company, has been nominated for the presidency of the American Society of Mechanical Engineers.

PAUL JOHN KRUESI, president and general manager of the Southern Ferro Alloys Company, has been elected president of the American Electrochemical Society at the annual business meeting held in Bridgeport on April 26.

CARLETON W. STURTEVANT, civil engineer, of New York, has been appointed by President Coolidge to be the civil engineer member of the Mississippi Flood Control Commission, created by the flood control bill.

DR. JOHN P. BUWALDA, professor of geology at the California Institute of Technology, has been appointed a member of a committee of three advisers to assist in the solution of problems confronting the U. S. Department of the Interior in the managing of Yosemite Valley in California.

THE office of chairman of the National Council of Scientific Research for Canada has been accepted by Dr. Henry M. Tory, president of the University of Alberta.

DR. CHARLES BERRY WING, professor of structural engineering at Stanford University, has been appointed director of parks for the state of California.

JOHN P. WENTLING, formerly of the division of forestry in the University of Minnesota, has been appointed director of the research division of the Western Red Cedar Association, with headquarters at Minneapolis.

GEORGE LYNN, formerly physical chemist of the U. S. Bureau of Mines, Helium Division, Pittsburgh, Pennsylvania, has accepted the position of research chemist with the Pittsburgh Plate Glass Company, Barberton, Ohio.

S. C. LANGDON has dropped his teaching work at Northwestern University to take charge of chemical research for Curtis Lighting, Inc., Chicago.

TWO members of the University of California College of Agriculture will be placed on the retired list next July: Dr. Elwood Mead, professor of rural institutions, becomes emeritus professor in that department, and Warren T. Clarke becomes emeritus professor of agricultural extension.

PROFESSOR JOHN W. HARSHBERGER, of the botanical department of the University of Pennsylvania, will visit Algeria, North Africa, this summer, crossing the Atlas Mountains to the northern part of the Sahara Desert to the oases of Biskra, Colomb Bechar and Touggourt. *En route,* he will visit the forests of Atlas cedar. Leaving North Africa, he will proceed *via* Naples, Rome and Leghorn to the Island of Corsica, to acquaint himself with its flora. Homeward-bound, he will cross the French Alps from Nice *en route* to Paris.

DR. A. G. MCCALL, director of soil investigation in the Maryland Agricultural Experiment Station, has arrived in England. He intends to visit the Rothamsted Station at Harpenden, afterward going to the Continent to confer with the chiefs of a number of European experimental stations on the subject of soil investigation.

DR. E. O. ULRICH, associate in stratigraphic paleontology at the U. S. National Museum, left on May 16 for six weeks' field work on the Cambrian and Ozarkian rocks of Oklahoma.

DR. NAGANICHI KURODA, the well-known Japanese ornithologist, visited the division of birds in the U. S. National Museum the last of April. Dr. Kuroda is on his way to Geneva to attend the International Con-

gress for the Protection of Birds. Before his departure from Washington, he was given a dinner by the Baird Club.

DR. E. SCHRATZ, assistant in the Kaiser Wilhelm Institute für Biologie, Berlin, is the recipient of a fellowship from the International Education Board, under the terms of which he will carry on some studies of long-lived cells with Dr. D. T. MacDougal at the Desert Laboratory of the Carnegie Institution of Washington. Dr. Schratz will also be associated with Dr. Forrest Shreve in work on anatomy and distribution of desert plants with reference to lime formations.

PROFESSOR FRIEDRICH HUND, of the University of Rostock, has been appointed lecturer in physics in Harvard University for the second half-year of 1928–1929. Professor Hund will lecture on "Molecular and Atomic Spectra."

THE Massachusetts Institute of Technology announces a ten weeks' course of lectures and laboratory work in colloid chemistry, to be given the coming summer by Ernst A. Hauser, director of the Colloid Laboratory of the German Metallbank und Metallurgische Gesellschaft, Frankfurt.

PROFESSOR ROSS G. HARRISON, of Yale University, delivered a lecture on May 21 at University College, London, on "Modern Trends in the Study of Animal Development."

DR. W. F. G. SWANN, director of the Bartol Research Foundation of the Franklin Institute, addressed the Society of the Sigma Xi on May 4 at the Ohio State University on the subject "The Earth's Electric Charge." The following day he addressed the Central Ohio Physics Club in the Mendenhall Laboratory on "Some Recent Atomic Theories."

DURING a recent visit to the Pennsylvania State College, Dr. Charles A. Shull, professor of plant physiology at the University of Chicago, addressed the honorary agricultural society, Gamma Sigma Delta, on "The Relation of the Fundamental Sciences to the Agricultural Experiment Stations," and the Penn State Science Club on "The Life and Work of Stephen Hales."

DR. W. J. HUMPHREYS, of the U. S. Weather Bureau, gave an illustrated lecture on "Clouds and Cloud Splendors" before the New York Academy of Sciences on the evening of May 7.

PROFESSOR F. R. WATSON, of the University of Illinois, gave an address on May 17 on "Ideal Auditorium Acoustics" at the annual convention of the American Institute of Architects.

ON May 3, Dr. Maude Slye, of the University of Chicago, spoke at Iowa State College on her work concerning cancer and heredity.

SIR FRANK DYSON, astronomer royal, delivered his presidential address to the British Institute of Physics on May 15, taking as his subject "Physics in Astronomy."

THE Romanes lecture for 1928 was given in the Sheldonian Theater, London, on May 4 by Professor D. M. S. Watson, Jodrell professor of zoology and comparative anatomy in the University of London. Professor Watson took as his subject "The Paleontology and the Evolution of Man."

DR. CHARLES H. GILBERT, professor of zoology at Stanford University, died on April 20, aged sixty-eight years.

FELIX DEUTSCHE, president of the Allgemeine Elektriziatets Gesellschaft and one of Germany's foremost industrialists, died on May 19, aged seventy years.

THE Louisiana Academy of Sciences, which was organized at Centenary College on March 5, 1927, held its first annual meeting at Louisiana College, Pineville, Louisiana, on May 5, under the presidency of Professor I. Maizlish, of Centenary College. Dr. H. A. Wilson, professor of physics at the Rice Institute, gave the principal address. His subject was "Recent Theories of Atomic Structure." It was voted that the next annual meeting shall be held at the Southwestern Louisiana Institute, Lafayette, Louisiana.

THE American Dairy Science Association will hold its annual meeting at the University of Wisconsin, from June 26 to 28 inclusive. The meeting will bring together research workers, agricultural extension agents, breeders and representatives of large milk plants, butter, cheese and ice cream manufacturers. Dairying in the broadest sense will be discussed from many different angles. Plans are being made for a number of demonstrations, inspection visits and conferences in some of the principal dairy centers of the state. It is expected that every agricultural experiment station and every agricultural school in the United States will be represented.

TWO congresses of mathematicians have been held since the war; at Strasbourg in 1920, and at Toronto in 1924. It is proposed to hold a congress at Bologna in 1929, at which delegates from Central Europe will be present for the first time. M. Mussolini has agreed to act as honorary president and Professor Pasquale Sfameni as president. The executive committee is being organized by Professor Salvatore Pincherle, and

the general secretariat by Professor Ettore Bartolotti. It is proposed to organize various sections, including pure mathematics, and mathematics applied to economic, scientific and technical problems. Members of the congress will be invited to make excursions to Florence and Ravenna.

IN celebration of the fiftieth anniversary of the foundation of the Folk-Lore Society, which was established in January, 1878, it has been decided to hold a Folk-Lore Congress in London from September 19 to 25. An advisory council is being formed to promote the congress, which is intended to be international in character. Many papers have already been promised, and it is proposed to include in the program exhibits and performances of folk-lore interest, visits to museums, etc. The subscription to the congress has been fixed at 10s. 6d. for members living in Great Britain, and at 7s. 6d. for those living abroad.

THE council of the Royal Geographical Society has received a radio message from Captain Wilkins thanking them for the award of the Patron's medal, and offering for the museum of the society the small British flag which he has carried through more than 15,000 miles of Arctic flying. The council accepted this gift, which will be placed beside the Union Jack flown by Sir Edward Parry on his sledge journey to latitude 82° 45′ North a century before. Captain Wilkins will be present to receive his medal at the anniversary meeting on June 18, and it is expected that both he and Lieutenant Eielson will be guests of the society at the anniversary dinner the same evening.

TWENTY-THREE honor graduates of British institutions of learning have received Commonwealth Fund Fellowships for study in the United States, including the following in the fields of science: Cyril D. Forde, University College, London; cultural history of North America from geographical and anthropological viewpoint, at the University of California. George A. Cumming, St. Andrews; geology, especially structure and stratigraphy, at the California Institute of Technology. Robert Spence, Armstrong College, Durham; physical chemistry, at Princeton University. Robert H. Angus, Sidney Sussex College, Cambridge; protection of high voltage and electric traction systems, at Stanford University. John M. Robertson, Glasgow; organic chemistry, at the University of Michigan. Norman Peter Inglis, Liverpool; strength of materials and fatigue of metals, at the University of Illinois. Catharine C. Steele, St. Andrews; organic chemistry with reference to optical activity, at the University of Illinois.

THE House on May 12 passed a bill designed to insure adequate supplies of timber by providing a 10-year program of reforestation. The bill sets up a series of authorizations covering the activities of the forest experiment stations. The House amended the Senate bill in passing it by providing for the establishment of additional forest experiment stations in Alaska and Hawaii and one additional station in a southern state. It is contemplated that appropriations under all the sections of the bill will approach the maximum authorizations under each section by approximately equal increases over the 10-year period until the maximum amount authorized, $3,575,000, is reached.

AT Ohio State University this spring a gold medal will be awarded for the first time from the Lamme Foundation, of which the late Benjamin Garver Lamme, who was chief engineer of the Westinghouse Electric and Manufacturing Company, is the donor. The medal, which contains $100 worth of gold, is to be awarded every five years to a graduate in any branch of engineering at Ohio State University.

COLONEL CHARLES LINDBERGH took his airplane, "Spirit of St. Louis," to Washington on April 30 for the purpose of turning it over to the Smithsonian Institution. The machine is to be exhibited in the Arts and Industries Building of the U. S. National Museum and plans have been made for suspending it just inside the main entrance. Approaches from galleries on either side will make it possible for visitors to see the interior of the cockpit at close range.

THE will of the late Harmon W. Hendricks, of New York, leaves $250,000 to the Museum of the American Indian, of which he was vice-president.

A TOTAL of $175,000 has been raised toward the building fund of the San Diego Natural History Museum. The total amount sought is $250,000.

ACCORDING to *Museum News*, the first arboretum in West Virginia will be established at Wheeling. It will cover an area of approximately 70 acres and will include several miles of trails, along which signs and labels will be placed to instruct visitors in natural history.

THE discovery of basket maker remains in cave shelters in southern New Mexico near Las Cruces, and in southwestern Texas in the vicinity of El Paso is the most important result of the Peabody Museum's Southwestern expedition of 1927 under direction of Mr. C. B. Cosgrove. Specimens recovered included the spear thrower or atlatl, long light darts with stone-tipped foreshafts, twined-woven bags, containers made from the skins of small mammals and other objects characteristic of the classic basket maker (Basket Maker II) culture, the earliest agricultural group in the Southwest. The find serves to extend southward by several hundred miles the known range of this very ancient people.

Two research fellowships in organic chemistry carrying a salary of $2,000 each a year have been organized for the coming year in the Sterling Chemistry Laboratory of Yale University. They will be known as the Milton Campbell research fellowships in organic chemistry and will be open only to men who have received their Ph.D. degree. Application for these fellowships with complete credentials should be directed to Professor Treat B. Johnson. A graduate fellowship in organic chemistry has been tendered to the Sterling Chemistry Laboratory by the Eli Lilly Laboratories for the year 1928–29. It has been awarded to Mr. Robert M. Herbst.

A census of the scientific workers of the Soviet Union has been taken by the Russian Academy of Sciences. There are altogether about 26,000 scientific workers active in the U. S. S. R., of which 12,000 are living in Leningrad and Moscow. A reference book on the scientific institutions of the U. S. S. R. is being issued by the academy.

DR. J. MCKEEN CATTELL, editor of SCIENCE, sails for Europe on May 26, returning on August 5. During this interval editorial communications should be addressed to Dr. McKeen Cattell, whose address is Garrison, N. Y.

UNIVERSITY AND EDUCATIONAL NOTES

COLTON LABORATORY, built and equipped to care for the departments of physics, chemistry and biology at Hiram College, was dedicated May 12. The building consists of three stories over a full basement and is constructed of concrete, brick and stone. It is named in honor of Professor George H. Colton, who was a teacher of the sciences at Hiram College from 1873 to 1926. Addresses were made by Dr. H. C. Cowles, Dr. Harry N. Holmes and Dr. H. B. Lemon, representing, respectively, botany, chemistry and physics.

THE departments of mathematics and physics of Princeton University have announced the following special program of graduate courses and lectures during the coming academic year in the field of recent developments in mathematical physics: Professor H. Weyl will lecture on "Group Theory and Quantum Mechanics." He will be assisted by Dr. H. P. Robertson, visiting assistant professor from the California Institute of Technology. Professors Eisenhart and Robertson will offer a course in "The Mathematics of the Newer Quantum Theory." Professor E. U. Condon will give a course in "Wave Mechanics," with special emphasis on the physical concepts and applications.

DR. JAMES I. SCARBOROUGH has been appointed head of the department of surgery at the University of Arkansas, to assume his new duties on September 15.

DR. LEE WALLACE DEAN, formerly of the University of Iowa, has been appointed full-time professor of oto-laryngology in the Washington University School of Medicine. Dr. Dean will assume his duties immediately.

THE recent promotion of Dr. Selig Hecht to a full professorship of biophysics in Columbia University was incorrectly reported in SCIENCE as being in the department of biochemistry.

DR. J. C. GEIGER, for five years connected with the faculty of the University of Chicago, has arrived at the University of California to accept an appointment as associate professor of epidemiology in the medical school and Hooper Foundation for Medical Research.

DR. M. T. TOWNSEND, of St. John's College, Md., has been appointed associate professor of histology and embryology in the medical school at the University of Oklahoma.

MISS HOPE HIBBARD, fellow in the International Education Board, at present in Paris, has been appointed assistant professor of zoology at Oberlin College.

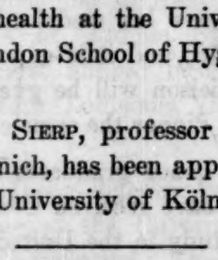
DR. W. W. JAMESON has been appointed to the chair of public health at the University of London, tenable at the London School of Hygiene and Tropical Medicine.

DR. HERMANN SIERP, professor of botany in the University of Munich, has been appointed to the chair of botany in the University of Köln.

DISCUSSION AND CORRESPONDENCE

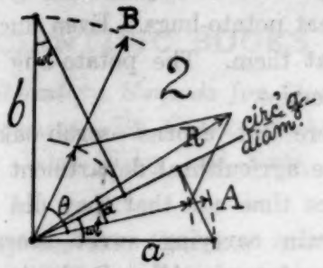
THE LITTLE CIRCLE OF REFERENCE

ONE usually defines a simple harmonic motion as the motion of the projection of a uniformly circulating point on a fixed diameter. It may sometimes with advantage be defined as the motion of the projection of a fixed circumferential point on a uniformly circulating diameter, relatively to that diameter. In figure 1



the two y's and the two x's are obviously the same, the angular displacement of the diameter at t seconds being ωt. The foot point from a lies on what may be called the little circle of reference; and since $x=$

cos ωt and $y' = x \sin \omega t = (a/2) \sin 2\omega t$, the new circulating point runs with twice the original angular speed, and half the amplitude. Now suppose the amplitudes a and b in figure 2 are at right angles, and



have a common circulating diameter. Their foot points from the ends of a and b will lie on little circles of reference with diameters a and b and at distances $a \cos \omega t$ and $b \sin \omega t$ from the center of the common circulating diameter.

Finally let A and B be any two given vectors of length a and b. Lay off the segments just obtained along the directions A and B, and let R be their sum. Then $R = A \cos \omega t + B \sin \omega t$ the familiar ellipse, selecting A and B as conjugate radü. The relation of the angles ωt and α which begin together, and the constant θ (see figure) though easily found, is naturally complicated; but it is usually of no interest.

CARL BARUS

BROWN UNIVERSITY

OCCURRENCE OF A MUTANT MEADOW-MOUSE

WHILE trapping for rodents along the roadside on the outskirts of Ann Arbor, Michigan, an adult female meadow-mouse, *Microtus pennsylvanicus pennsylvanicus*, with marked color differentiation, was captured alive on October 30, 1927. The roadside here slopes gradually to a natural depression, the sides of which are covered with uncut red clover and where Microtus runways are common. The mouse was captured not more than twenty feet from the concrete road. Compared with Ridgway's color chart, the color of the pelage is as follows: back and sides, drab-gray at the tips of the hairs and white at the bases; belly, pale smoke-gray; nose and extending up between and slightly above the eyes, drab; dorsal streak on tail, hair, brown. The eye-color was red. Unfortunately the mouse died on December 16, 1927, curtailing any chance of breeding. It is now preserved as a specimen in the mammalian collection of the University of Michigan.

The authors are indebted to Dr. H. W. Feldman for the following notes concerning the possible genetic constitution of this mutant:

The color-pattern is unmistakably agouti and compared with other mutant forms of murine rodents, the specimen bears a close similarity to the albino allelomorphs. It seems to indicate a condition midway between the ruby-eyed variety of the Norway rat, *Rattus norvegicus* (as described by Whiting and King[1]), and the extreme dilution of the house-mouse, *Mus musculus* (as found by Detlefsen[2]). If the differences in the normal intensity of the pelage coloration of the meadow-mouse are considered, this mutant represents a deviation as great for the former species as extreme dilution does for the latter. Since albino meadow-mice have been noted by Dunn,[3] the albino series in this form probably consists of at least three allelomorphs.

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ARTHUR SVIHLA

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NOTES ON THE OCCURRENCE OF SARCOCYSTIS

RECENTLY in the preparation of histological sections of muscle, we encountered two cases of parasitic infestation, which seem worth recording. The parasites appear to belong to the order Sarcosporidia, genus Sarcocystis. Wenyon[1] in his "Protozoology" discusses this order with other groups under the heading, "Parasites of Undetermined Position." The members of the genus Sarcocystis, as the name indicates, share the common characteristic of forming, in one stage of the life cycle, cysts within the fibers of skeletal and cardiac muscle. Within the typical cysts are found the characteristic "banana-shaped" spores. Considerable variation has been reported in the sizes of both the cysts and the spores.

In one of our cases cysts of this parasite occur in the heart-muscle of the ox. The preparations were made especially for the study of the Purkinje fibers, and the parasites are found within these as well as within the ordinary cardiac muscle-fibers. Large normal cardiac fibers measure 36 micra in diameter. The smallest cyst which we have observed in such fibers measures 36 micra. Another in oblique section measures 89 by 440 micra and the largest 105 micra in cross-section, in which latter case no definite remains of the muscle-fiber can be made out. Strands of the syncytium of Purkinje fibers measure from 36 to 240

[1] Whiting, P. W., and King, Helen Dean, 1918, "Ruby-eyed Dilution, a Third Allelomorph in the Albino Series of the Rat." *Jour. Exp. Zool.* 26: 55–64.

[2] Detlefsen, J. A., 1921. "A New Mutation in the House-mouse." *Amer. Nat.* 55: 469–473.

[3] Dunn, L. C., 1921. "Unit Character Variation in Rodents." *Jour. Mamm.*, vol. 2: no. 3: 125–140.

[1] Wenyon, C. M., 1926, "Protozoology," Vol. I, pp. 760–769.

micra in diameter. In a Purkinje fiber of the moderator band a cyst occurs which measures 170 micra. There are cysts in the fibers of the bundle of His ranging in diameter from 60 to 234 micra.

In the second case the cysts are found in the pectoralis major muscle of the turkey-buzzard. Fibers of this muscle measure 56 micra in diameter. Sections of three cysts measure, respectively, 52, 57 and 65 micra. Sections of the buzzard's heart were prepared and studied, but no cysts were found.

The spores within the cysts of the beef-heart measure 3 to 4 micra in diameter and 16 to 18 micra in length. Those in the buzzard measure 2 by 9 micra. In both the beef-heart and the buzzard-muscle the fibers adjacent to those containing cysts appear perfectly normal. Neither is there any connective-tissue-reaction to the presence of the cysts.

Although these parasites have been repeatedly described in the hearts of various species,[2] we have not found specific mention of their occurrence in the Purkinje fibers. Wenyon tabulates thirty-five species of Sarcocystis with four additional cases in which the species were not named. We have found no mention of these parasites occurring in the turkey-buzzard, either in the general literature or in Wenyon's book, although he lists nine other species of birds in which they have been found. The finding of these parasites in the buzzard is interesting in view of Crawley's statement[3] that "whereas the purely herbivorous cattle are practically invariably infected, records of the finding of sarcosporidian cysts in the muscles of carnivorous animals are very rare."

Alexeieff,[4] who studied these forms extensively, concluded that there is no means of telling what the species may be, and that, in spite of variations in size, all belong to the same species. Hence, we merely record that we found Sarcocystis sp. as described above in the Purkinje fibers of the beef-heart and in the skeletal muscle of the turkey-buzzard (*Carthartes aura septentrionalis*).

H. L. OSTERUD,
K. F. BASCOM

MEDICAL COLLEGE OF VIRGINIA,
RICHMOND, VA.

[2] Manifold, J. A., 1924–25, "A Case of Human Sarcosporidiosis." Trans. Roy. Soc. Trop. Med. & Hyg., London, xviii.

Hadwen, S., 1922, "Cyst-forming Protozoa in Reindeer and Caribou and a Sarcosporidian Parasite of the Seal (Phoca richardi)." *J. Am. Vet. M. Assn.*, Vol. lxi.

[3] Crawley, H., 1916, "The Zoological Position of the Sarcosporidia," Proc. Acad. Nat. Sc., Phila., Vol. lxviii.

[4] Alexeieff, A., 1913, "Recherches sur les Sarcospiridies." Arch. de Zool. exp. et gen., li, pp. 521–569.

QUAILS, POTATO-BUGS AND OTHER THINGS

HERE in Beaufort, S. C., there are many potato-bugs and quails. It may not be generally known that quails eat potato-bugs. Even ducks and guineas refuse to eat them. The potato-bug seems to have very few enemies.

Quails here eat acorns—scrub-oak and live-oak acorns. The agricultural department at Washington told me some time ago that they did not know of a live-oak strain carrying sweet acorns. There are three of these trees in Allen Park, Augusta, Ga., and I know one here on the Harvey place. The acorn is as sweet as the meat of a chinquapin, and by the way these chinquapin trees grow here thirty feet high and have bushels of chinquapins on them.

Another interesting tree which grows wild here is the Chinese tallow. Chickens fly up into the tree to eat these quite edible seeds. When the pods have burst and an oily seed is placed on a live coal it sends up a white flame six or eight inches high which burns steadily for three or four minutes.

In the up-country the *Magnolia grandiflora* is an ornamental lawn-tree. Down here it is a regular forest-tree only, with diameter of three or four feet and grows along with slash pine and live-oak in the forest.

N. L. WILLET

BEAUFORT, S. C.

THE EARLIEST DYNAMO

I NOTE in your issue of April 13 a notice of the approaching fiftieth anniversary of the invention of the dynamo. I desire to call your attention to the fact that in the Centennial Exposition of 1876 there were two dynamos on exhibition known as the Gramme Dynamo. These machines were made in Paris. At the close of the exposition, Professor Barker, of the University of Pennsylvania, bought the larger of these machines and I bought the smaller one for the young institution of learning, Purdue University. Following the close of the exposition my Gramme machine was sent to Lafayette and installed in the chemical laboratory. I also built a lamp which was very successful, mounted it in the cupola of the university and illuminated the city of Lafayette late in November with the first electric light ever shown west of the Alleghenies and generated by a dynamo. This machine remained in use in the physical and chemical laboratory of Purdue University up to a recent date, and is still in an excellent condition. It has now been installed in the museum of Purdue, properly labeled with the data

which I have just described. Evidently the celebration of the fiftieth anniversary of the dynamo should have been held about two years ago.

H. W. WILEY

SCIENTIFIC BOOKS

Biochemical Laboratory Methods for Students of the Biological Sciences. By CLARENCE AUSTIN MORROW, PH.D., John Wiley and Sons, New York, 1927.

THIS book by the late Clarence Austin Morrow, until his death in 1926 professor of biochemistry at the University of Minnesota, is a volume which will be welcomed by all teachers and students in biochemistry, botany, general physiology, pathology, agronomy and bacteriology. It was written by a man who had had extensive teaching experience in biochemical laboratory methods. Each of the experiments given in the book, and there are two hundred and thirty-three, has been thoroughly tested out in the student laboratory by college classes.

The general field of physical and chemical biology is greatly in need of texts. This volume by Dr. Morrow fulfills one of these needs. As one reads the interesting experiments outlined, one wishes again and again that the author had wandered astray to discuss the theory of the behavior of nitrogen-containing compounds. It is hoped, therefore, that this laboratory manual of biochemistry will soon have a companion volume, by some equally capable teacher and writer, dealing with the theory of biochemical behavior.

Too often in laboratory manuals are the time-honored and time-worn methods given so that the student comes to think that this is the only way and these the only materials, but in Dr. Morrow's book this is not the case. The experiments are well chosen and depart in the main from stereotyped forms.

The first chapter is on the "Colloidal State" and covers the subject briefly but well. The only adverse criticism which I can make of Dr. Morrow's book has to do with subject-matter handled in this first chapter. The faults are not serious, and I call attention to them more because they happen to touch upon two subjects in which I, for some time, have had a personal interest. Morrow helps to perpetuate the now antiquated term "emulsoid." This expression has become so firmly established in physical and chemical biology that it seems difficult to eradicate it even though it has long since been discarded by most chemists and never was accepted by such colloidists as Zsigmondy and Donnan. There is not sufficient reason to believe, nor do many workers in the field now believe, that hydrophilic colloids of the gelatin type are fine emulsions. We can, however, partially forgive Dr. Morrow for continuing the use of this expression, a relic from the early days of colloidal chemistry, since he has done the very correct thing of putting the emulsions in a class by themselves, where they, as liquid suspensions, belong.

The second adverse criticism has to do with the support which is given to the attempt of others to draw a distinction between viscous and plastic flow; but here Dr. Morrow has numerous capable investigators on his side. The conception that plastic flow is fundamentally different from viscous flow is a sound one and is based on the fact that viscous substances flow no matter how low the rate of shear, provided the shearing force acts over a sufficient interval of time, while plastic substances do not flow until a certain definite shearing force has been exceeded. Plasticity is made up of two fundamental properties, yield value and mobility. The former is dependent upon the shearing stress required to start deformation, while the latter is proportional to the rate of deformation after the yield value has been exceeded. These properties and the distinction they emphasize between viscous and plastic flow are generally recognized and hold for such a substance as lead which does not exhibit viscous flow until a maximum stress is applied. The fact that lead will flow, as when forced through small holes under pressure, does not interfere with our conception of lead as a solid; but with colloidal jellies the case is different.

To call a thin solution of gelatin or soap a solid, because it possesses such solid properties as elasticity and rigidity, even though its viscosity may be but twice that of water, is as misleading and as meaningless as it would be to call metallic lead a liquid. The distinction between liquid and solid becomes purely arbitrary when applied to colloidal substances of the gelatin type.

But a more serious objection to the point of view that elastic colloidal solutions exhibit plastic flow is that plasticity already has a definite meaning in physics and refers to that property which permits a substance to be deformed and yet show no tendency to return to the original shape. This is not true of elastic colloidal substances such as gelatin, rubber, protoplasm or any jelly.

The whole difficulty in this matter seems to me to lie in the failure to realize that in solutions of gelatin and the like we are dealing with two properties, viscosity and elasticity, and the type of flow is determined by the presence of these two properties. Gelatin is not plastic. No elastic substance can be

if we stand by our old and recognized definitions. Gelatin does not at first show true viscous flow because of the interference of elasticity, or, if we get back to the cause of elasticity in jellies, because of the presence of a structural framework. When this structure is broken down, *i.e.*, when the elastic property is completely overcome, as is true at maximum stress, then true viscous flow results. This is seen in determinations by Freundlich of viscosity coefficients of elastic solutions by the capillary (Hess viscometer) method. The measured viscosity value rapidly falls with increase in pressure until a maximum stress (of 60 mm. Hg) is reached when the curve becomes a straight line. At this point of maximum pressure elasticity no longer interferes with capillary flow. The structure of the liquid elastic jelly is broken down and true viscous flow, with constant viscosity values, results. This, then, is the explanation of the deviation from Poiseuille's formula of elastic colloidal solutions.

The preceding criticisms are directed not against Morrow's excellent volume but against two viewpoints which, in the first case, has long persisted in biology, and, in the second case, is a new conception for which there does not appear to be sufficient justification.

The second chapter of Biochemical Laboratory Methods has to do with the Physical Chemical Constants of Plant Saps. Here Morrow gives methods for determining osmotic pressure, molecular weight, water binding power, and electric conductivity, using in every case plant sap as experimental material, thus pointing out that what sometimes appears to be a course in physical-chemistry is really the application of physical-chemical methods to biology.

Chapter three, on H-ion Concentration, illustrates again the excellent method of presentation followed in the book. In this chapter Morrow has given the biological student all he needs to know of H-ion concentration in order to do good work and to understand the subject without losing himself in a maze of theory and mathematics.

Chapter four is on the Proteins, their tests, and their preparation. It is this phase of the subject with which Dr. Morrow was especially well acquainted, and it is also that field of experimental endeavor which has made the Division of Agricultural Biochemistry of the University of Minnesota so well known. The chapter, therefore, becomes a valuable contribution to our knowledge of the isolation of natural plant proteins. Some of the experiments have to do with animal material, as cystine from hair, tryptophane from casein, etc.

Perhaps the most encouraging thing which the teacher of biochemistry will find in the fourth chapter of this book is the realization that it is possible to prepare in the student laboratory reasonably pure plant proteins. The preparations are not easy, but they can be done by the student and have, in addition, the pedagogical value of teaching the student that pure proteins are things to be worked with under carefully controlled conditions. By the time the student has isolated globulin from the peanut, or gliadin from wheat flour, or prepared some of the amino acids such as tryptophane from casein, as described by Morrow, he will have a wholesome respect for the value of his preparations, and yet have the satisfaction of knowing that he can do the work and do it well. The classical work of eminent investigators on plant proteins is likely to discourage not only the student but the teacher from attempting to duplicate even the simplest of these experiments in class laboratories. When confronted with such difficulties it has always been my policy to go ahead and do the best that I can. If the answer to the question of whether or not an experiment is to be attempted is to rest on the degree of precision or purity of the results, then many a biological problem will remain untouched. Who, after all, knows what a pure protein is? The same difficulty confronts every worker on living matter. One of the most impressive features of Morrow's book is the realization that precise physical-chemical methods are brought to bear on biological problems and that biology is gradually becoming an exact science, an encouraging thing when one realizes the many almost insurmountable difficulties involved in experimental work on living matter.

I recall with amusement the irritable attitude of a physicist who objected to my crude method of determining the viscosity of protoplasm. He said it would be so simple a matter to make precise observations by merely running the protoplasm through a capillary viscometer! I remember, too, the similar state of mind of a chemist who was annoyed at my speculating on the structure of protoplasm when he did not yet know the structure of such relatively simple non-living substances as gelatin. It is a joy, therefore, as one reads Morrow's book to appreciate the extent to which chemistry has brought accuracy into biology, just as physics brought accuracy into chemistry, and as mathematics has brought accuracy to all.

Chapter five deals with the Carbohydrates. Methods of extraction and identification of the saccharides are given. A considerable variety of plant material is selected as a source for extracting sugars.

Chapter six on the Glucosides, and seven on the Fats. Animal material is again resorted to, as a source for cholesterol and lecithin.

Chapter eight has to do with Enzymes and chapter nine with Plant Pigments.

These last chapters of the book are much more complete than this brief review indicates, for they represent, as I have said, that field of biochemistry to which Morrow devoted his life. The value of these chapters is greatly added to by the giving of methods which have not before appeared in print, methods developed not only by Morrow himself but by his colleagues.

Dr. Morrow's book on biochemical laboratory methods is one which should be in the hands of every teacher and student in biochemistry, biophysics and physiology.

WILLIAM SEIFRIZ

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A COMBINED FIXATIVE AND STAIN FOR DEMONSTRATING FLAGELLA AND CILIA IN TEMPORARY MOUNTS

BELOW is given a new fixative-stain combination, which has proved to be especially suitable for the rapid preparation of temporary mounts to show flagella and cilia. The reagent contains:

80 cc	saturated solution of phenol in water
20 cc	40 per cent. solution of formaldehyde in water
4 cc	glycerine
20 mgms	gentian violet

It is advisable, in order to facilitate the dissolving of the dye, to moisten it thoroughly with a cubic centimeter of water before adding the other ingredients.

Mix a drop of the reagent with a drop of the culture or infusion containing the organisms to be studied. The flagella and cilia stain clearly, while the cell body remains quite natural in shape and sufficiently transparent to observe the nucleus and the other cytoplasmic structures, such as granules, pharyngeal rods, chloroplasts, pyrenoids, paramylum bodies and the like. The background remains practically colorless, the dye concentrating itself in the organisms. The depth of the stain can be regulated by varying the proportions of reagent to infusion.

The reagent promises to be extremely useful in demonstrating flagella to elementary classes and in identifying the minute flagellates in protozoology courses. It has been used with surprising success on Oicomonas, Tetramitus, Menoidium, Peranema, Euglena, Astasia, Chilomonas, Polytoma, Naegleria and others. It will undoubtedly prove useful as a quick method for studying the flagellated stages of algae, fungi and myxomycetes.

The cilia, cirri, membranelles and undulating membranes of the ciliates are stained by it in approximately natural form, permitting an accurate determination of the number of the ciliary rows, and the arrangement and number of the cirri, membranelles and membranes. To any one who has tried to work out the exact arrangement of the locomotor organelles of a small hypotrich the advantage of such a reagent is obvious.

For staining internal protozoan parasites it is advisable to use more glycerine and dye (approximately 8 cc glycerine and 25 mgms gentian violet have given good results). The presence of mucus interferes with the staining process. It is consequently advisable to mix the material to be examined with three or four times its volume of normal salt solution before using the reagent. With these precautions the method has been used with success on Trichomonas, Chilomastix and Balantidium. With further work along this line it might be possible to develop a method that would materially facilitate the diagnosis of intestinal and other parastic protozoa.

Unfortunately the reagent does not work well with Paramecium, since the discharge of the trichocysts tends to tear away the cilia, but satisfactory preparations have in some cases been obtained in spite of this difficulty. With smaller ciliates, such as Cyclidium, Colpidium, Urotricha, Colpoda and Aspidisca, the method works beautifully; and in larger forms without a heavy trichocyst layer very satisfactory results have been obtained, for example with Stylonchia, Ophryoglena and Chilodon. The cilia stand out as clear blue, individual threads.

Bacteria stain clearly and stand out distinctly against the colorless background. It is possible in the filamentous types to observe the gelatinous sheath in which the rods are imbedded. However, the flagella of the motile forms, such as the larger spirilla and bacilli commonly found in laboratory infusions, do not take the stain.

LOWELL E. NOLAND
UNIVERSITY OF WISCONSIN

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(4) Make any number of the desired prints. Print the transparent negative as in (2). The prints are made on any desired surface of paper. Greatest definition is secured by the use of glossy paper. A good glossy print is as detailed as was the original.

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EDGAR P. JONES

ZOOLOGY DEPARTMENT,
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SPECIAL ARTICLES

THE PARATHYROID GLANDS AS INFLUENCED BY SELECTIVE SOLAR RADIATON

SINCE hyperplasia of the parathyroid glands occurs in animals kept upon a diet deficient in calcium, and since calcium metabolism is dependent upon vitamin D, present either in the diet or in the lesser wave-lengths of sunlight, an experiment was tried to determine the effect of selective solar radiation upon the parathyroid glands of chicks maintained upon diets in which the content of calcium was adequate.

Four convenient pens were constructed and screened upon their southern exposure by amber, blue, ordinary and vitaglass filters, transmitting variable portions of the sun's spectrum. Each of these four pens was divided by a median partition, so that four pairs of compartments, each pair illumined through a single filter, were thus arranged. The basic diet employed throughout the experiment was the Wisconsin ration, Bulletin 371, Agr. Exp. Station, Madison, Wis. This ration, without the cod-liver oil, was provided the chicks in one compartment of each filter; while the cod-liver oil was added to the diet in the other compartment of each filter. The chicks were placed in he filters on April 22, 1927, and the experiment was discontinued October 25, six months later. Certain chicks in each pen were killed after two, three, four, eight and twelve weeks of experimental observation. The thyroids and parathyroids were fixed in Bouin's fluid, sectioned and stained for histological study. Differential blood counts, serum calcium and phosphorus were determined at frequent intervals throughout the study.

The normal parathyroid tissue in the chick is massed into a pair of small glands which lie at the caudal angle of each thyroid lobe. Each gland is an epithelial structure, surrounded by a thin capsule which continues within the gland as the stroma. The cells comprising the gland are arranged into irregular groups or cords, sometimes alveolar or tubular in organization. The cells are usually large and contain elliptical nuclei with numerous nucleoli. Mitotic figures are frequently seen.

After three weeks of observation a differential growth in these glands under the various filters is manifest. Hyperplasia is more apparent in the glands of those chicks grown under the blue and amber filters on a diet devoid of cod-liver oil. In the chicks kept under these filters and fed the cod-liver oil the glands are smaller than those without the oil, but are larger than the parathyroids of chickens grown in the compartments having vitaglass or ordinary window-glass. Vitamin D, present in the cod-liver oil, appears to compensate partially for the absence of direct sunlight, at least in so far as the size of the parathyroids is concerned.

In the absence of the optimal wave-lengths of sunlight the chicks immediately evidence an increase in the number of parathyroid cells, apparently normal and of entirely functional significance. Chickens taken from compartments with blue or amber filters and maintained upon a diet without the cod-liver oil have parathyroids at the end of one month nine times the size of the gland in a chick grown under the vitaglass filter on the same diet.

Progressive changes within the hyperplastic glands become manifest about the end of the first month. Such regression is first manifest by an increase in the extent of the connective tissue stroma followed by a destruction of the normal cords and columns of cells. Hyperemia is also characteristic of such regression. Two distinct types of cystic degeneration occur within these hyperplastic glands. These cysts appear to be composed of extensive mucoid deposits walled off, in one case, by a high columnar epithelium and in the other case by a series of pavement cells concentrically arranged. The columnar cells of the first type appear to be formed by parathyroid cells of the normal columns, which break away to wall off the developing cyst from the adjacent parathyroid tissue. The origin of the concentric pavement cells is not clear, although those cells appear to arise in connec-

tion with the hyperplasia of the connective tissue stroma. Giant cells are frequently found associated with these cysts.

Light of certain wave-lengths appears to bear a definite relationship to the physiology of the parathyroid glands. In the absence of the optimal light factors, an attempt is made by the organism to compensate for this loss by an increase in the total functional activity of the gland. Hyperplasia ensues in the absence of the lesser wave-lengths of sunlight but such hyperplasia is partially obviated by the addition to the diet of a small portion of cod-liver oil. These experiments indicate that normal development of the parathyroids will best maintain in the presence of both the lesser and the greater wave-lengths of sunlight.

GEORGE M. HIGGINS
CHARLES SHEARD
MAYO CLINIC AND MAYO FOUNDATION

A NEW TYPE OF ACID CARBOHYDRATE FROM SEAWEED

NATURALLY occurring acidic materials, essentially carbohydrate in nature, have been known for many years, though they have been investigated comparatively little from the standpoint of structural chemistry. We know little more about the chemistry of gums than was known by the chemists of thirty years ago. Many gums occur in nature as inorganic salts of complex organic acids, which on hydrolysis break down to mixtures of both pentoses and hexoses, and form also acidic products of unknown composition. That these acidic substances are *uronic* acids or polymers or derivatives of such acids is indicated by the fact that they liberate CO_2 when boiled with 12 per cent. HCl and that they give the naphtho-resorcin test.[1] That conjugated *uronic* acids are constituents of many polysaccharides found in plants is indicated by the work of various investigators, among them Nanji and others,[2] Erich Schmidt and coworkers,[3] Schwalbe and Feldtman,[4] and also by unpublished observations of the present writers.

Of late certain substances of this general class, namely, the pectins and the soluble specific substances produced by various types of pneumococcus have been submitted to careful study with interesting results. Ehrlich[5] and his coworkers have found that digalacturonic acid is formed by hydrolysis of pectin, along with sugars—mainly arabinose and galactose—and that this acid or polymers of it constitute a considerable proportion of the pectin molecule. Very recent work by Heidelberger and Goebel[6] shows an aldobionic acid—glucoso-glucuronic—to be the fundamental building stone of the polysaccharide derived from Type III pneumococcus and to be an important constituent in that from Friedlander's bacillus.

We are now able to report, in a preliminary way, a new type of carbohydrate material which apparently is made up completely of *polyuronic* acid. Quantitatively, at least, this material bears the same relation to *uronic* acid that starch does to glucose.

A sample of seaweed, gathered at Woods Hole, Massachusetts, in April and classified as *laminaria agardhii*, was extracted with cold dilute Na_2CO_3. After filtering, the so-called alginic acid was precipitated by addition of HCl and freed from salt by washing and dialysis. It was dried over P_2O_5 to constant weight and analyzed. The results of analysis indicate the formula $(C_6H_8O_6)n$, which is also closely checked by titration with standard alkali. The compound loses 24.5 per cent. of its weight as CO_2 on boiling with dilute HCl. This indicates that the molecule is at least 98 per cent. *uronic* anhydride, probably even more, as the loss of CO_2 from a *uronic* acid is said to be not quite quantitative.[7]

We have also isolated alginic acid from *macrocystis pyrifera*—the giant kelp of the Pacific coast. Our work to date indicates that this material is also a polyuronic anhydride to the extent of at least 98.6 per cent.

But little study, beyond the determination of the analytical data, has been made of the alginic acid from *laminaria agardhii*. Enough work has been done, however, with that from the *macrocystis pyrifera* to indicate that it is a very interesting substance, worthy of careful investigation. The pure acid does not reduce Fehling's solution, but becomes reducing if dried at 100° or if boiled with distilled water for a short time. By the action of heat in the presence of water, the substance loses CO_2. Because of these facts, it is our opinion that the analytical data and physical constants, obtained by previous investigators[8] working with this material, may be inaccurate. Changes were undoubtedly brought about in the substance, before it was analyzed, on drying at 100°.

Schmidt and Vocke[9] have recently isolated what they considered to be a mixture of polyglucuronic acids from *fucus serratus*. These acids, as they found them in the plant, were bound with varying amounts of other carbohydrates. They obtained, on hydrolysis of this material, an acid whose cinchonine salt

[1] Tollens, *Ber.*, 41, 1788, 1908.
[2] *J. Soc. Chem. Ind.*, 44, 253T, 1925.
[3] *Ber.*, 58, 1394, 1925.
[4] *Ber.*, 58, 1534, 1925.
[5] *Biochem. Z.*, 168, 263, 1926; *ibid.*, 169, 13, 1926.
[6] *J. Biol. Chem.*, 74, 613, 1927; *ibid.*, 74, 619.
[7] Nanji, Paton and Ling, *loc. cit.*
[8] Hoagland and Lieb, *J. Biol. Chem.*, 23, 287, 1915.
[9] *Ber.*, 59, 1585, 1926.

melted at 204°, the melting-point of the cinchonine salt of glucuronic acid as reported by Neuberg.[10]

We have hydrolyzed the alginic acid from *macrocystis*, following exactly the method of Schmidt and Vocke, and have obtained a substance having the properties of a hexonic aldehyde acid. Its cinchonine salt melts at 152°. The acid is, therefore, not glucuronic. That this is the case is also indicated by the fact that on oxidation with bromine or nitric acid no saccharic acid was obtained.

The absence of mucic acid in the oxidation products also excludes galacturonic acid as the structural unit of the original material.

Glucuronic and galacturonic acids are the only aldehyde sugar acids hitherto found in nature.

We are continuing work on the chemistry of plant gums and the acidic portions of the algae, and will report more fully in a short time.

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UNIVERSITY OF PITTSBURGH

SOCIETIES AND ACADEMIES

THE THIRTY-EIGHTH ANNUAL MEETING OF THE OHIO ACADEMY OF SCIENCE

THE thirty-eighth annual meeting of the Ohio Academy of Science was held at the University of Cincinnati, Cincinnati, O., on Friday and Saturday, April 6 and 7, 1928, under the presidency of Dr. Harris M. Benedict, of the University of Cincinnati. The attendance was good, the atmosphere notably congenial, the programs well balanced, the public lectures and sectional papers highly satisfying, and the hospitality of the City of Cincinnati generous and winning. The central theme of the meeting was the relation between physics and biology, as emphasized by the presence and notable lecture of Dr. William T. Bovie, of the Medical College, Northwestern University, on "The Relation of Physics to Biology," the lecture by President Schneider on results from the Basic Laboratory of the University of Cincinnati, the lecture by Dr. S. J. M. Allen on the use of the X-ray as a means of investigating the structure of protoplasm, the lecture by Dr. Albert P. Mathews on some aspects of the problem of coagulation of the blood, and the lecture by J. B. Kelly, of the Bell Telephone Laboratories of New York, on "Recent Researches in Audition." In addition, there were some 85 or 90 papers read before sectional meetings.

The officers elected for the coming year were: *President,* James S. Hine, Ohio State University; *vice-presidents,* zoology, Annette Braun; botany, E. Lucy Braun; geology, Charles H. Behre, Jr.; medical sciences, Albert P. Mathews; psychology, Samuel Renshaw; physical sciences, E. H. Johnson; *secretary,* William H. Alexander; *treasurer,* A. E. Waller; *elective members of the executive committee,* R. C. Osburn and Stephen R. Williams; *trustee research fund,* George D. Hubbard.

Fellowship was bestowed upon the following members: Chas. H. Behre, Jr., Fred A. Hitchcock, Robt. A. Moore, Katharine Dooris Sharp, John P. Visscher and Frank J. Wright, and some 60 or more new members were elected.

The academy went on record as unanimously in favor of H. R. 6091, Seventieth Congress, first session, by Mr. John McSweeney, M. C.

WM. H. ALEXANDER,
Secretary.

SIGMA PI SIGMA CONVENTION

SIGMA PI SIGMA, national honorary physics fraternity, held its convention at Davidson College, Davidson, N. C., April 10 and 11. The reports of the national officers and the delegates from the various chapters showed growth in the strength of the fraternity and an increasing interest in its work. Chapter representatives were present from Davidson College, Duke University, the Pennsylvania State College, Furman University, Centenary College and the College of William and Mary. All the officers and members of the Executive Council were present, as follows: *President,* R. W. Graves; *vice-president,* Marsh W. White; *secretary-treasurer,* H. E. Fulcher; *councilors,* J. M. Douglas, W. N. Mebane and C. C. Hatley.

At the conclusion of the business session on the afternoon of April 10 Professor R. C. Young, of the College of William and Mary, presented a paper on "The Use of the Vacuum Tube Oscillator in Making Laboratory Measurements."

At an open meeting at 7:30 P. M. Professor J. M. Douglas gave a short talk on "The Aims and Ideals of Sigma Pi Sigma." Professor McConnel, of Davidson College, welcomed the fraternity upon behalf of the faculty and the administration of the college. The principal address of the evening was given by Dr. Marsh W. White, of the Pennsylvania State College, upon the subject: "The Energy Relations in X-ray Tubes."

Officers were elected at the business sessions on April 11 as follows: *President,* Professor C. C. Hatley, of Duke University; *vice-president,* Professor R. C. Young, of the College of William and Mary; *secretary-treasurer,* Professor Marsh W. White, of the Pennsylvania State College; *councilors,* Professors J. M. Douglas and W. N. Mebane, of Davidson College.

[10] *Ber.,* 33, 3317, 1900.

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SCIENCE NEWS

Science Service, Washington, D. C.

RED ARC LIGHT FOR FOG

A BRILLIANT red arc light that makes use of the rare atmospheric gas neon, and which can shine through thick fog, has been developed at the research laboratory of the General Electric Company. The new lamp is the result of the work of Dr. Clifton G. Found, in collaboration with J. D. Forney, of the Cooper-Hewitt Electric Company, and was recently demonstrated by them to engineers.

Airplane landing fields will probably be among the first to make use of the lamp, for by outlining the fields with them aviators flying above through fog will be enabled to make a safe landing. Such an occurrence as that of Commander Byrd on his flight to Paris, when he actually flew over Le Bourget, but could not see to land, would probably be prevented.

Docks in harbors may also be marked with the lamp. According to Dr. Found, the light has been tested for this use when one was recently placed on a pier in the Hudson River. "Observations from boats during fog," he says, "have shown that it was possible to pick up the red neon light before any of the other lights in the same vicinity were observed."

Earlier forms of neon tubes, which give the characteristic red neon light that is now so common in advertising signs, suffer from what is called the "cathode drop." This is the great difference in voltage between the electrode through which the electric current enters the tube, and the near-by gas. On account of it, also, tubes must be operated with a high voltage, and must be made quite long in order to be efficient. Another disagreeable effect is that the gas is made to gradually disappear.

The new tube of Dr. Found and Forney heats the cathode, or the electrode through which the current enters the tube, by means of an additional electric circuit. This causes it to give off the electrons which cause the neon gas to glow, but without the high voltages that are needed in the older tubes. By such means an extremely efficient source of brilliant red light can be obtained. Light of this color is best for penetrating fog.

Another possible use of the lamp is in photography, especially in colors. The mercury vapor-lamp, which gives a characteristically violet-colored light, has often been used for ordinary photography, but the unnatural pallor which it causes is a disadvantage, especially where colors are concerned. By combining the neon light with the mercury vapor-lamp, the former supplies the red rays which are lacking in the latter, and the result is a good approximation to white light.

SYNTHETIC SUGAR

THE synthesis of sugar by two Swiss chemists, Professor Ame Pictet and Hans Vogel, has aroused great interest among the chemists in this country. For this is a problem on which investigators have worked in vain for over fifty years because of its scientific interest and possible commercial importance. Sugar of the common sort, extracted from cane or beet, is easily split up, or, as it is called, "inverted," by weak acids, forming two other sugars. One of these is glucose, which is now manufactured in the United States from corn. The other half is fructose, which can be manufactured from Jerusalem artichoke, as has recently been demonstrated by the U. S. Bureau of Standards.

But to bring these two sugars together so as to form sugar of the common or table variety has hitherto been impossible. Professor Pictet has discovered that the difficulty has come from the fact that fructose exists in two forms identical in composition, but differing in the arrangement of their atoms. By transforming the normal fructose over into what is called the "gamma" form he was able to combine this with an equal amount of glucose and get sucrose or common sugar. This he accomplished by first joining to each molecule of glucose and fructose four molecules of acetic acid, the acid of vinegar. After the two sugars have been combined the acid is easily eliminated by alkali.

Since this is a difficult and expensive process it could not be employed on a commercial scale, but it is important as proving that it is possible to make sugar artificially and it suggests the possibility of inventing new kinds of sugar which are not to be found in nature. Some of them might prove to be sweeter than common sugar or safer for the use of diabetics.

Professor Pictet, of the University of Geneva, is now seventy-one years old and has long been one of the world's leading authorities on the constitution of sugar and cellulose. Within the last two years he has succeeded in synthesizing two other of the double sugars, lactose, which occurs in milk, and maltose, which occurs in malt.

PHOTOGRAPHS ON STEEL

SHOOTING a photograph into the hardest of chrome steel with the aid of high explosive nitrogelatin, and so making a photographic record as permanent as the steel itself, is the feat that has been accomplished as a result of the "Munroe effect." This effect was the discovery of Dr. Charles E. Munroe, of the U. S. Bureau of Mines. An incidental result of the work is the proof that the blacks in a photographic print are due to varying thicknesses of finely divided silver, the thicker the deposit, the darker being the shadow in the photograph.

The steel photograph was made recently by G. St. J. Perrott, superintendent of the Bureau of Mines Experiment Station at Pittsburgh, and sent by him to Dr. Munroe. To make it, a photograph of Dr. Munroe was laid on a piece of steel about two inches in diameter and an inch thick. On top of this was placed a disc-shaped piece of the nitrogelatin explosive, which was then fired. Though the paper photograph was completely destroyed, when the steel cooled sufficiently to be handled, the profile of Dr. Munroe was found impressed on the surface. Where the photograph had been black, that is, in the

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THE INDIANA SAND DUNES AND SHORE LINES OF THE LAKE MICHIGAN BASIN. George B. Cressey. pp. xii+80. $2.00.

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shadows, the surface of the steel was raised, and where there had been high lights, the steel was incised.

Another example of the effect that is in Dr. Munroe's possession now was made by W. O. Snelling, director of research of the Trojan Powder Company. In this case the words "Munroe effect" were impressed into the surface of a block of the explosive, so that the letters were in intaglio. When this was exploded on a disc of the steel the letters appeared on it. However, they were also in intaglio on the steel. This is the opposite from what would be obtained with a die, for then the intaglio letters on the die would come out in relief on the finished product.

Dr. Munroe explains the effect by saying that when the detonation of the explosive occurs, the entire amount of the solid is converted to gas. This volume of gas, however, momentarily has the same size and shape as the original block of the explosive, and is therefore extremely compressed. Where there was a cavity in the original explosive is the line of least resistance for the escape of the rapidly moving gas molecules. In seeking to escape, they collide with each other, producing a vast number of tiny molecular drills, which bore into the hardest steel.

Using the same principle, Dr. Munroe once blew a hole in a safe with a hollow cylinder of dynamite. He took a bundle of sticks of dynamite, then, by pushing a tin can through the center, he pushed out the center sticks, and bound together the other ones so as to form a ring. This he exploded in a vertical position upon a safe. The result was a hole in the top of the safe corresponding to the hollow center in the ring of dynamite sticks. This hollow cylinder had acted as a gun to fire the gas molecules through the steel.

Any thin objects, such as a leaf, or photograph, can be reproduced on steel in this way, and so a permanent record can be obtained. The explosion has the effect of greatly magnifying slight differences in thickness, such as between the layers of silver in the shadows and highlights of the photograph.

ZINC AND BORON FOR PLANTS

THE common metal zinc, together with boron, the chemical basis of borax, are needed by plants if they are to live and grow in full health, according to Miss A. L. Sommer and Professor C. B. Lipman, of the University of California, as described in an article in *The Scientific Monthly*. The amounts needed are exceedingly minute; one part of each in two million parts of the solution surrounding the roots will suffice, but without these microscopic quantities plants drag out a dwindling, sickly existence or even perish altogether. These minerals, together with several others needed in equally minute amounts, are likened by the experimenters to the almost undetectably small amounts of the vitamins needed by man and the lower animals.

To test the response of plants to such low concentrations of the two elements, most elaborate precautions had to be taken, the two researchers report. Even the dust of the air might carry enough zinc or boron to feed a plant otherwise kept completely deprived of it by specially refined chemicals dissolved in double-distilled water; so a smaller greenhouse was built inside a large one, and all the air used in ventilating it carefully filtered. Since ordinary glass contains a little zinc, the jars used in part of the experiments were made of pyrex glass.

A number of different kinds of plants were grown in the culture jars. One set was given a properly balanced ration of mineral nutrients, but no zinc. Another set was similarly deprived of boron. Other plants were supplied with a full ration plus both boron and zinc, in the very low concentration of one part of each to two million parts of water. The plants supplied with both boron and zinc made a healthy and flourishing growth, while those that lacked either of the two elements showed only a fraction of normal growth or even failed to advance beyond the seedling stage.

THE RECENT PACIFIC EARTHQUAKE

BY means of records obtained on seismograph instruments at observatories as distant as Massachusetts, Alaska, Hawaii and the Philippine Islands, and gathered by Science Service, the earthquake experts of the U. S. Coast and Geodetic Survey have located the center of the quake on May 14. It was at latitude 8.0 degrees south and longitude 80.5 degrees west, and occurred at 5 hours 14 minutes 20 seconds P. M., Eastern Standard Time. This location is in the Pacific Ocean about 70 miles off the Peruvian coast. Fortunately for residents of this region, the slip of the ocean bed which produced it was mostly in a horizontal direction. Had the shaking been up and down, a severe tidal wave would doubtless have been the result.

At Guayaquil, Ecuador, nearly four hundred miles to the north of the center of the shake, severe shaking was reported. This, and the fact that seismograph observatories at such distant points recorded it, shows that it was a quake of great severity.

The seismograph stations that reported their records of the quake to Science Service were those of the U. S. Coast and Geodetic Survey at Tucson, Arizona, Sitka, Alaska, Honolulu, T. H., and Chicago, Ill.; of the Jesuit Seismological Association at Georgetown University, Washington, Fordham University, New York; Regis College, Denver; Loyola University, New Orleans, and St. Louis University, St. Louis; and the stations of Harvard University, Cambridge; the Dominion Observatory, Ottawa, Canada, and the Manila Observatory in the Philippine Islands.

THREE ECLIPSES IN ONE MONTH

THREE eclipses in a single month, one of the moon and two of the sun, the first of the trio happening on Saturday, May 19, form the coming celestial program. This is the first time that three eclipses have followed at such short intervals since 1924, and the last time that it will happen until 1931, say astronomers at the Nautical Almanac Office of the U. S. Navy Department.

Since an eclipse happens when the shadow of the moon, cast by the sun, falls on the earth, or when the moon itself gets into the earth's own shadow which stretches

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out into space, an eclipse can not happen any oftener. It takes two weeks for the moon to travel from a position between the earth and sun, to one where the earth is between the moon and the sun. An eclipse occurring at the former position is of the sun, and one at the latter is of the moon.

On May 19, the moon's shadow swept across a small area about a thousand miles south of South Africa, just on the edge of the Antarctic region that Commander Byrd will explore next year. As the eclipse was extremely brief, and the region where it was visible most inaccessible, no astronomers traveled to see it.

Two weeks later, by June 3, the moon will be half way around its orbit encircling the earth, and then will enter the earth's shadow. As the moon is lighted by the sun, it will then be temporarily darkened. Unfortunately for most American observers, this eclipse happens after the moon has set for all but the extreme western states, and so will not be visible over the greater part of the country. From Hawaii and the Philippines, as well as eastern Asia, it will be possible to view it.

When another two weeks have passed, on June 17, the moon will again be between the sun and earth, and then part of its shadow will cross the Antarctic region. During this eclipse, at no part of the earth's surface will the sun be completely covered by the dark lunar disc. Therefore, like the first of the trio of eclipses, this one will be completely without scientific importance.

Unfortunately for astronomers, eclipses that are really satisfactory for observing can not occur as often as this. When the moon's shadow lands squarely on the earth, by the time the moon travels around its orbit again, the shadow will miss the earth completely. The next eclipse that Americans can observe without leaving the country will be on August 31, 1932, and will be seen in parts of Maine, Vermont, New Hampshire and Massachusetts.

ITEMS

A CURIOUS crop is described in a bulletin of the Missouri Botanical Garden. It consists of a tomato vine grafted on a potato stock, which yields tomato fruits above and potato tubers below. The graft is fairly easy to make, it is stated, requiring no more skill than is needed for a similar operation on an apple twig. Apparently the first one on record was made over a century ago by an amateur scientist named De Tchudi, who reported his experiments to the Horticultural Institute at Fromont in France. Neither partner in this double plant body seems to have any influence on the other. The tomatoes are like those of sister plants grown on their own roots, and the potatoes differ in no way from those grown in the ordinary way from other eyes cut from the same parent tuber.

ANCIENT mythologies tell of gods slain by their worshippers; and something of the kind is happening in the Big Tree grove of Mariposa County, where thousands of tourists are unconsciously destroying that which they come hundreds of miles to admire. At the request of the National Park Service, Dr. E. P. Meinecke, U. S. Forest Service plant pathologist, has investigated the present status of the cherished sequoias and has reached the conclusion that long-continued and heavy tramping of human feet has destroyed the root endings and finer roots of many of the trees. Without these of course the trees are unable to absorb water and mineral nutrients from the soil. The rescue of Grizzly Giant, one of the finest Big Trees in existence, from a similar fate about 25 years ago, is recalled. Trampling had destroyed its endings, and friends of the trees were at a loss to know what to do. Finally it was suggested by George T. Harlow, at that time guardian of the grove, that the soil surrounding the tree be loosened somewhat and that additional soil be placed around the tree and over the roots to a height of three or four feet. The experiment, though ridiculed at the time, proved entirely successful, and the old tree was restored to health.

A COUNTRY zoo, where tired animals of the London Zoo can go for a holiday and where sick animals can go to recuperate, is proposed in a bill considered by the British Parliament. The estate which would be set aside for the animals covers 480 acres and provides enough room for the animals to exercise in surroundings somewhat like their natural home country. The holiday home for the wild animals would be about 40 miles from London.

YELLOWSTONE PARK headquarters at Mammoth Hot Springs will have a house built of elk antlers to display to visitors during the coming season, as part of the exhibits of the park museum. It will be only a little house, containing a single room six by eight feet and seven feet high, but even so its construction will require some thousands of pairs of antlers. Each year every adult male in the 20,000 elk in the park herds sheds a pair of antlers, so that large quantities of these have been easy to obtain. Enough have been brought to Mammoth Hot Springs to provide walls and roof for the "house of horn," which Chief Ranger Sam Woodring has undertaken to construct.

THE insect-catching leaves of a southern species of pitcher plant are sometimes borrowed by tree frogs for their own insect-catching purposes, according to Professor E. A. Andrews, of the Johns Hopkins University. On several occasions, during a sojourn in North Carolina, he found these little yellow-green frogs ensconced inside the narrow, trumpet-shaped hollow leaves of the pitcher-plant, whose color almost exactly matched the color of the froglets. Inasmuch as the leaves of the pitcher-plant normally serve as traps for insects, whose remains apparently nourish this predatory vegetable, it seems that the frogs were in a way playing the part of parasites, by robbing the plants of their rightful prey as it tumbled in at the mouths of the pitchers. In a few instances the frogs were in their turn cheated, for he observed frog-inhabited leaves across whose openings spiders had spun their webs, so that any insect undertaking to enter the inviting mouth of the trap would reach neither the frog's stomach nor the plant's digestive pit at the base of the leaf.